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ABSTRACT

Two learning activity packets (LAPs) are provided for the instructional area of accessories in the auto mechanics II program. They accompany an instructor's guide available separately. The LAPs outline the study activities and performance tasks for these two units: air conditioning and heaters. A cover sheet to each LAP sets forth purpose, an introduction, and list of tasks included. Each LAP contains these components: a checklist of learning steps, pretest (with answers), and assignment sheets (with answers). (YLB)

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State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for AUTO MECHANICS II

LAP NO. _____ CODE: _____

MAJOR INSTRUCTIONAL AREA

SECTION D--ACCESSORIES

INSTRUCTIONAL UNIT

UNIT I--AIR CONDITIONING

LEARNING ACTIVITY PACKET NO. 20

PREREQUISITE LAP(S) None

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Air Conditioning." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.

INTRODUCTION: The course of study in this LAP will help the student become able to service an automotive air conditioning system.

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TASKS INCLUDED IN THIS LAP:

1. Connect manifold gauge set into system.
2. Purge the system.
3. Replace condenser.
4. Evacuate the system using a vacuum pump or charging station.
5. Leak test the system using a halide leak detector.
6. Charge the air-conditioning system using pound cans.
7. Remove and replace compressor crankshaft seal.

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SECTION D--ACCESSORIES
UNIT I--AIR CONDITIONING

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____ 1.	Read	Unit and Specific Objectives, page AM II-1-D.
_____ 2.	Complete	Air Conditioning Pretest, LAP page 11.
_____ 3.	Study	The sections of the Information Sheet, pages AM II-5-D through AM II-11-D, indicated by your instructor on your Pretest.
_____ 4.	Refer	To Step 8 of your Pretest. If additional study is required for the Information Sheet, Section I, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.
_____ 5.	Do	LAP Assignment Sheet #1, LAP page 21.
_____ 6.	Do	LAP Assignment Sheet #2, LAP page 27.
_____ 7.	Refer	To Step 8 of your Pretest. If additional study is required for any of the Information Sheet, Sections II through VII, continue to Learning Step 8. Otherwise, proceed to Learning Step 10.
_____ 8.	Do	LAP Assignment Sheet #3, LAP page 33.

LEARNING STEPS

_____ 9. Do — LAP Assignment Sheet #4, LAP page 37.

_____10. Check — The tasks below that you think you can perform without supervison.

Student Check		Instructor Initials/Date: Skilled	Moderately Skilled
_____	a. Connect manifold gauge set into system (15)	_____	_____
_____	b. Purge the system (21)	_____	_____
_____	c. Replace condenser (27)	_____	_____
_____	d. Evacuate the system using a vacuum pump or charging station (33)	_____	_____
_____	e. Leak test the system using a halide leak detector (39)	_____	_____
_____	f. Charge the air-conditioning system using pound cans (45)	_____	_____
_____	g. Remove and replace compressor crankshaft seal (51)	_____	_____

_____11. Discuss — Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 54.

_____12. Refer — To Learning Step 10a. If this task has been initialed by your instructor, proceed to Learning Step 18. Otherwise, continue to Learning Step 13.

LEARNING STEPS

_____13.	Study	Job Sheet #1--Connect Manifold Gauge Set into System, page AM II-55-D.
_____14.	Watch	Slide/tape presentation, "Connect Manifold Gauge Set into System" (D-I-1).
_____15.	Do	Job Sheet #1--Connect Manifold Gauge Set into System.
_____16.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10a and proceed to Learning Step 18. Otherwise, repeat Learning Steps 13 through 15 and then continue to Learning Step 17.
_____17.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10a and continue to Learning Step 18. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 10a and then continue to Learning Step 18.
_____18.	Refer	To Learning Step 10b. If this task has been initialed by your instructor, proceed to Learning Step 24. Otherwise, continue to Learning Step 19.
_____19.	Study	Job Sheet #2--Purge the System, page AM II-57-D.
_____20.	Watch	Slide/tape presentation, "Purge the System" (D-I-2).
_____21.	Do	Job Sheet #2--Purge the System.

LEARNING STEPS

_____22.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10b and proceed to Learning Step 24. Otherwise, repeat Learning Steps 19 through 21 and then continue to Learning Step 23.
_____23.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10b and continue to Learning Step 24. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 10b and then continue to Learning Step 24.
_____24.	Refer	To Learning Step 10c. If this task has been initialed by your instructor, proceed to Learning Step 30. Otherwise, continue to Learning Step 25.
_____25.	Study	Job Sheet #3--Replace Condenser, page AM II-59-D.
_____26.	Watch	Slide/tape presentation, "Replace Condenser" (D-I-3).
_____27.	Do	Job Sheet #3--Replace Condenser.
_____28.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10c and proceed to Learning Step 30. Otherwise, repeat Learning Steps 25 through 27 and then continue to Learning Step 29.

LEARNING STEPS

_____29.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderatly Skilled rating, have your instructor initial Learning Step 10c and continue to Learning Step 30. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 10c and then continue to Learning Step 30.
_____30.	Refer	To Learning Step 10d. If this task has been initialed by your instructor, proceed to Learning Step 36. Otherwise, continue to Learning Step 31.
_____31.	Study	Job Sheet #4--Evacuate the System Using a Vacuum Pump or Charging Station, page AM II-61-D.
_____32.	Watch	Slide/tape presentation, "Evacuate the System Using a Vacuum Pump or Charging Station" (D-I-4).
_____33.	Do	Job Sheet #4--Evacuate the System Using a Vacuum Pump or Charging Station.
_____34.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10d and proceed to Learning Step 36. Otherwise, repeat Learning Steps 31 through 33 and then continue to Learning Step 35.
_____35.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10d and continue to Learning Step 36. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 10d and then continue to Learning Step 36.

LEARNING STEPS

_____36.	Refer	To Learning Step 10e. If this task has been initialed by your instructor, proceed to Learning Step 42. Otherwise, continue to Learning Step 37.
_____37.	Study	Job Sheet #5--Leak Test the System Using a Halide Leak Detector, page AM II-63-D.
_____38.	Watch	Slide/tape presentation, "Leak Test the System Using a Halide Leak Detector" (D-I-5).
_____39.	Do	Job Sheet #5--Leak Test the System Using a Halide Leak Detector.
_____40.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10e and continue to Learning Step 42. Otherwise, repeat Learning Steps 37 through 39 and then continue to Learning Step 41.
_____41.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10e and continue to Learning Step 42. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 10e and then continue to Learning Step 42.
_____42.	Refer	To Learning Step 10f. If this task has been initialed by your instructor, proceed to Learning Step 48. Otherwise, continue to Learning Step 43.
_____43.	Study	Job Sheet #6--Charge the Air-Conditioning System Using Pound Cans, page AM II-65-D.

LEARNING STEPS

_____44.	Watch	Slide/tape presentation, "Charge the Air-Conditioning System Using Pound Cans" (D-I-6).
_____45.	Do	Job Sheet #6--Charge the Air-Conditioning System Using Pound Cans.
_____46.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10f and proceed to Learning Step 48. Otherwise, repeat Learning Steps 43 through 45 and then continue to Learning Step 47.
_____47.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10f and continue to Learning Step 48. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 10f and then continue to Learning Step 48.
_____48.	Refer	To Learning Step 10g. If this task has been initialed by your instructor, proceed to Learning Step 54. Otherwise, continue to Learning Step 49.
_____49.	Study	Job Sheet #7--Remove and Replace Compressor Crankshaft Seal, page AM II-69-D.
_____50.	Watch	Slide/tape presentation, "Remove and Replace Compressor Crankshaft Seal" (D-I-7).
_____51.	Do	Job Sheet #7--Remove and Replace Compressor Crankshaft Seal.

LEARNING STEPS

_____52.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10g and proceed to Learning Step 54. Otherwise, repeat Learning Steps 49 through 51 and then continue to Learning Step 53.
_____53.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 10g and continue to Learning Step 54. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 10g and then continue to Learning Step 54.
_____54.	Review	Information Sheet (pages AM II-5-D through AM II-11-D) and LAP Assignment Sheets.
_____55.	Take	Air Conditioning Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

SECTION D--ACCESSORIES
UNIT I--AIR CONDITIONING

PRETEST

NAME _____ SCORE _____

DIRECTIONS: This pretest is to determine how much you already know about air conditioning. Your performance on this pretest will not be used to determine your grade in the course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing may prevent you from receiving needed instruction.

1. Match terms and definitions associated with air conditioning. Write the correct numbers in the blanks.

__4__ a.	Device used to control temperature, humidity, and air movement	1. Air inlet valve
__1__ b.	Adjustable door in the plenum blower assembly that permits selection of outside and inside air for heating and cooling systems	2. Can valve
__6__ c.	Temperature of air surrounding an air-conditioned unit, such as a vehicle or building	3. Charge
__9__ d.	Outside air sensing switch used to control compressor clutch operation and prevent compressor operation at low temperatures when air conditioning is not required	4. Air conditioner
__7__ e.	Act of turning the service valve stem all the way counterclockwise until the valve is seated	5. Boiling point
__8__ f.	Motor-driven fan used to force air through the evaporator and to circulate the cooled air through the passenger compartment of the automobile	6. Ambient air temperature
__5__ g.	Temperature at which a liquid changes to a vapor	7. Back seating
__2__ h.	Mechanical device used to pierce, dispense, and seal small cans of refrigerant	8. Blower fan
__3__ i.	Specific amount of refrigerant or oil by volume or weight	9. Ambient compressor switch

18	j.	Act of placing a charge of refrigerant or oil into the air conditioning system
16	k.	Gas; gaseous state of refrigerant
12	l.	Gauge that will register both pressure and vacuum; used on the low side of the system
20	m.	Component of the refrigeration system that pumps refrigerant vapor and increases the pressure of the refrigerant
17	n.	Assembly mounted on the compressor crankshaft permitting the shaft to be turned without loss of refrigerant or oil
11	o.	Act of changing a vapor to a liquid
13	p.	Component of a refrigeration system in which refrigerant vapor is changed to a liquid by the removal of heat
14	q.	Substance other than refrigerant and refrigeration oil in the system
15	r.	Drying agent used in refrigeration systems to remove excess moisture
10	s.	To bleed some or all of the refrigerant from a system by opening a valve or connection and permitting the refrigerant to escape slowly
21	t.	Hose that connects the compressor outlet to the condenser inlet
19	u.	That portion of the refrigeration system under high pressure, extending from the compressor outlet to the thermostatic expansion valve inlet

10. Discharge
11. Condensation
12. Compound gauge
13. Condenser
14. Contaminant
15. Desiccant
16. Vapor
17. Compressor shaft seal
18. Charging
19. Discharge side
20. Compressor
21. Discharge line

28	v.	Device containing desiccant placed in the liquid line to absorb moisture in the system
24	w.	System short of refrigerant which will result in improper cooling
31	x.	To create a vaccuum within a system to remove all traces of air and moisture
32	y.	Compenent of an air conditioning system in which refrigerant liquid is changed into a vapor by removing heat from the air which is then discharged into the passenger compartment
30	z.	Thermometer scale using 0° as the freezing point of water and 100° as the boiling point of water
22	aa.	Device used with the drier or as a separate unit to remove foreign solid material from the refrigerant
27	bb.	Condition caused by too much liquid refrigerant being metered into the evaporator
26	cc.	To remove solid particles such as metal flakes or dirt from refrigerant passages
23	dd.	Formation of a froth of the oil and refrigerant due to rapid boiling out of the refrigerant dissolved in the oil when the pressure is suddenly reduced
29	ee.	Failure of a unit to operate properly due to the formation of ice at the expansion valve orifice or on the evaporator coils or fins
25	ff.	Act of closing compressor service valves by turning them all the way clockwise

22. Filter
23. Foaming
24. Underchage
25. Front seating
26. Flush
27. Flooding
28. Drier
29. Freeze-up
30. Celsius
31. Evacuate
32. Evaporator

44	gg.	Pressure of the refrigerant from the discharge reed valve through lines and condenser to the expansion valve orifice
35	hh.	Mechanical device used to evacuate the refrigeration system to rid it of excess moisture and air
42	ii.	Less than atmospheric pressure; expressed in inches of mercury
40	jj.	Device located on the discharge side of the compressor to allow the technician to check high side pressure and perform other necessary operations
37	kk.	Low side pressure higher than normal due to a malfunction of the system
39	ll.	To isolate or seal off with a nonconductor
36	mm.	Any device used to detect leaks in an air-conditioning system
45	nn.	Line connecting the drier outlet with the expansion valve inlet
43	oo.	High side pressure lower than normal due to a malfunction of the system
33	pp.	Device located on the suction side of the compressor to allow the technician to check low side pressure or perform other necessary service operations
41	qq.	Pressure lower than normal in the suction side of the system due to a malfunction of the unit
34	rr.	Coupling device used to turn the compressor on and off electrically
38	ss.	Indication of too much refrigerant or refrigeration oil in the system

33. Low side service valve
34. Magnetic clutch
35. Vacuum pump
36. Leak detector
37. High suction pressure
38. Overcharge
39. Insulate
40. High side service
41. Low suction pressure
42. Vacuum
43. Low head pressure
44. Head pressure
45. Liquid line

49	tt. Force per unit of area; pressure of refrigerant is measured in pounds per square inch (psi) or kilopascals (kPa)	46. Receiver-drier
48	uu. Difference in pressure between any two points that may be caused by a restriction or friction	47. Refrigeration cycle
52	vv. To remove moisture and air from a system or a component by flushing with a dry gas refrigerant	48. Pressure drop
55	ww. Air that is forced through the condenser coils by the movement of the vehicle or action of the fan	49. Pressure
46	xx. Combination container for the storage of liquid refrigerant and desiccant	50. Refrigeration oil
51	yy. Positive displacement compressor with pistons that travel back and forth in a cylinder	51. Reciprocating compressor
54	zz. Thin leaves of steel located in the valve plate of automotive compressors to act as suction and discharge valves	52. Purge
53	aaa. Refrigerant used in automotive air conditioners	53. Refrigerant-12 (R-12)
47	bbb. Complete circulation of refrigerant through an air-conditioning system accompanied by changes in temperature and pressure, such as changes of state from vapor to liquid to vapor	54. Reed valves
50	ccc. Highly refined oil free from all contaminants, such as sulfur, moisture, and tars	55. Ram air

__63__ ddd. Sensing device connected to the expansion valve by a capillary tube to sense temperature and transmit pressure to the expansion valve for its proper operation

__58__ eee. Spring-loaded valve similar to a tire valve located inside the service valve fitting and used on some control devices to hold refrigerant in the system

__64__ fff. Housing on the fire wall inside the engine compartment containing air ducts, air valves, and blower

__60__ ggg. Fitting located on the service valves and on some control devices to connect manifold gauge set charging hoses to air-conditioning system

__61__ hhh. Condition caused by poor air circulation or a thermostat out of adjustment causing the air-conditioning unit to run for very short periods

__59__ iii. Line connecting the evaporator outlet to the compressor inlet

__56__ jjj. That portion of the refrigeration system under low pressure extending from the expansion valve outlet to the compressor inlet

__62__ kkk. Back pressure regulated device that prevents evaporator core freeze-up

__65__ lll. Compressor inlet pressure which reflects the pressure of the system on the low side

__57__ mmm. Temperature-sensitive switch used to control the compressor clutch and cycle the compressor as a means of temperature control in an air-conditioning system

56. Suction side
57. Thermostatic switch
58. Schrader valve
59. Suction line
60. Service port
61. Short cycling
62. Suction throttling valve (STV, POA, and EPA valves)
63. Remote bulb
64. Plenum blower assembly
65. Suction pressure

2. Identify the components of the refrigeration system illustrated below. Write the correct names in the blanks.

Inlet half of expansion valve
Condenser
Evaporator
Discharge side of compressor and its high side service fitting
Suction side of compressor and its low side service fitting
Receiver-drier

a. Discharge side of compressor and its high side service fitting

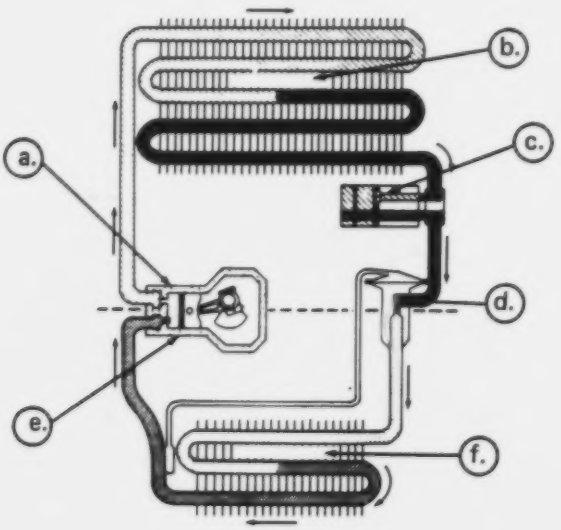
b. Condenser

c. Receiver-Drier

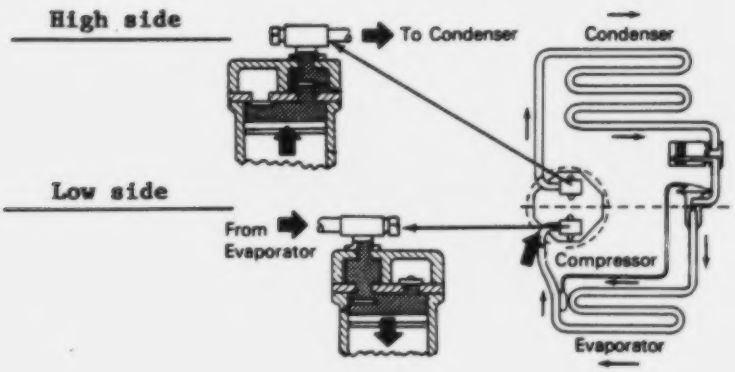
d. Inlet half of expansion valve

e. Suction side of compressor and its low side service fitting

f. Evaporator



3. Label the high and low sides of the compressor illustrated below. Write the correct names in the blanks.



4. List six safety rules for automotive air conditioning.

ANSWER SHOULD INCLUDE ANY SIX OF THE FOLLOWING:

a. **Do not inhale fumes from burned fluorocarbon gases**

b. **Do not warm a refrigerant can over 125°F (15°C)**

c. **Do not abuse a refrigerant container**

d. **Do not allow high side pressure to enter refrigerant container**

e. **Wear safety glasses and a full face shield or sealed goggles while working on an air-conditioning system**

f. **Do not apply torch to a pressurized system**

g. **Inspect all pressure hoses, gauges, and connections before using**

h. **Do not pump liquid refrigerant into a compressor**

i. **Ventilate a gas-filled area before working there**

5. State the function of a receiver-drier (dehydrator).

To provide storage of liquid refrigerant and to absorb moisture in the system

6. Label the back seat, midposition, and front seat of the service valves illustrated below. Write the correct names in the blanks.

a. Midposition b. Front seat c. Back seat

7. Identify the components of the manifold gauge set illustrated below. Write the correct letters in the blanks.

c Low side gauge

g High side hand valve

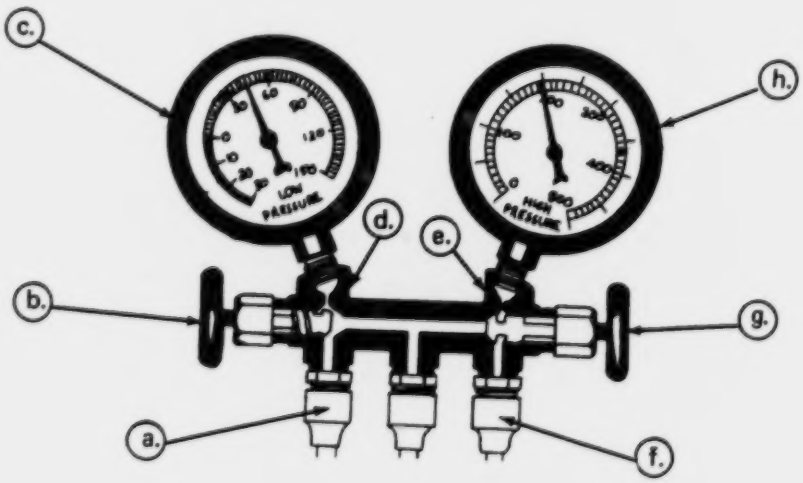
f High side test hose

d,e Manifold

a Low side test hose

b Low side hand valve

h High side gauge



PRETEST

8. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

I _____ II _____ III _____ IV _____

V _____ VI _____ VII _____

If none of the above sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 3.

SECTION D--ACCESSORIES
UNIT I--AIR CONDITIONING

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Match terms and definitions associated with the air conditioning system. Write the correct numbers in the blanks.

PART I--GENERAL TERMS

3	a.	Thermometer scale using 0° as the freezing point of water and 100° as the boiling point of water
8	b.	To create a vacuum within a system to remove all traces of air and moisture
12	c.	Act of changing a vapor to a liquid
6	d.	To isolate or seal off with a non-conductor
1	e.	Force per unit of area; pressure of refrigerant measured in pounds per square inch (psi) or kilopascals (kPa)
10	f.	Less than atmospheric pressure; expressed in inches of mercury
5	g.	Difference in pressure between any two points that may be caused by a restriction or friction
9	h.	Gas; gaseous state of refrigerant
2	i.	Drying agent used in refrigeration systems to remove excess moisture
11	j.	Temperature of air surrounding an air-conditioned unit, such as a vehicle or building
7	k.	Temperature at which a liquid changes to a vapor
4	l.	Substance other than refrigerant and refrigeration oil in the system

1. Pressure
2. Desiccant
3. Celsius
4. Contaminant
5. Pressure drop
6. Insulate
7. Boiling point
8. Evacuate
9. Vapor
10. Vacuum
11. Ambient air temperature
12. Condensation

LAP ASSIGNMENT SHEET #1

GENERAL TERMS (Continued)

17	m.	Specific amount of refrigerant or oil by volume or weight	13. Can valve
			14. Air conditioner
14	n.	Device used to control temperature, humidity, and air movement	15. Compound gauge
15	o.	Gauge that will register both pressure and vacuum; used on the low side of the system	16. Reciprocating compressor
			17. Charge
13	p.	Mechanical device used to pierce, dispense, and seal small cans of refrigerant	18. Flush
18	q.	To remove solid particles such as metal flakes or dirt from refrigerant passages	
16	r.	Positive displacement compressor with pistons that travel back and forth in a cylinder	

PART II--AIR CONDITIONING AND REFRIGERATION TERMS

7	a.	Condition caused by too much liquid refrigerant being metered into the evaporator	1. Freeze-up
			2. Leak detector
2	b.	Any device used to detect leaks in an air-conditioning system	3. Overcharge
			4. Undercharge
6	c.	Act of placing a charge of refrigerant or oil into the air conditioning system	5. Discharge
			6. Charging
5	d.	To bleed some or all of the refrigerant from a system by opening a valve or connection and permitting the refrigerant to escape slowlly	7. Flooding
3	e.	Indication of too much refrigerant or refrigeration oil in the system	
1	f.	Failure of a unit to operate properly due to the formation of ice at the expansion valve orifice or on the evaporator coils or fins	
4	g.	System short of refrigerant which will result in improper cooling	

LAP ASSIGNMENT SHEET #1

AIR CONDITIONING AND REFRIGERATION TERMS (Continued)

13	i.	Highly refined oil free from all contaminants, such as sulfur, moisture, and tars
15	j.	Formation of a froth of the oil and refrigerant due to rapid boiling out of the refrigerant dissolved in the oil when the pressure is suddenly reduced
16	k.	Act of closing compressor service valves by turning them all the way clockwise
12	l.	High side pressure lower than normal due to a malfunction of the system
19	m.	Refrigerant used in automotive air conditioners
14	n.	Air that is forced through the condenser coils by the movement of the vehicle or action of the fan
9	o.	Pressure lower than normal in the suction side of the system due to a malfunction of the unit
17	p.	Act of turning the service valve stem all the way counterclockwise until the valve is seated
21	q.	Complete circulation of refrigerant through an air-conditioning system accompanied by changes in temperature and pressure, such as changes of state from vapor to liquid to vapor
11	r.	Pressure of the refrigerant from the discharge reed valve through lines and condenser to the expansion valve orifice
10	s.	Low side pressure higher than normal due to a malfunction of the system
8	t.	Compressor inlet pressure which reflects the pressure of the system on the low side

8. Suction pressure
9. Low suction pressure
10. High suction pressure
11. Head pressure
12. Low head pressure
13. Refrigeration oil
14. Ram air
15. Foaming
16. Front seating
17. Back seating
18. Short cycling
19. Refrigerant-12 (R-12)
20. Purge
21. Refrigeration cycle

AIR CONDITIONING AND REFRIGERATION TERMS (Continued)

18 u. Condition caused by poor air circulation or a thermostat out of adjustment causing the air-conditioning unit to run for very short periods

20 v. To remove moisture and air from a system or a component by flushing with a dry gas refrigerant

PART III--AIR CONDITIONING COMPONENTS

2 a. Device located on the suction side of the compressor to allow the technician to check low side pressure or perform other necessary service operations

5 b. Thin leaves of steel located in the valve plate of automotive compressors to act as suction and discharge valves

4 c. Line connecting the drier outlet with the expansion valve inlet

6 d. That portion of the refrigeration system under low pressure extending from the expansion valve outlet to the compressor inlet

3 e. Mechanical device used to evacuate the refrigeration system to rid it of excess moisture and air

7 f. That portion of the refrigeration system under high pressure, extending from the compressor outlet to the thermostatic expansion valve inlet

1 g. Device located on the discharge side of the compressor to allow the technician to check high side pressure and perform other necessary operations

1. High side service valve
2. Low side service valve
3. Vacuum pump
4. Liquid line
5. Reed valves
6. Suction side
7. Discharge side

LAP ASSIGNMENT SHEET #1

AIR CONDITIONING COMPONENTS (Continued)

11	h.	Device containing desiccant placed in the liquid line to absorb moisture in the system
14	i.	Component of the refrigeration system that pumps refrigerant vapor and increases the pressure of the refrigerant
16	j.	Device used with the drier or as a separate unit to remove foreign solid material from the refrigerant
9	k.	Housing on the fire wall inside the engine compartment containing air ducts, air valves, and blower
12	l.	Combination container for the storage of liquid refrigerant and desiccant
15	m.	Adjustable door in the plenum blower assembly that permits selection of outside and inside air for heating and cooling systems
13	n.	Temperature-sensitive switch used to control the compressor clutch and cycle the compressor as a means of temperature control in an air-conditioning system
8	o.	Sensing device connected to the expansion valve by a capillary tube to sense temperature and transmit pressure to the expansion valve for its proper operation
17	p.	Component of an air conditioning system in which refrigerant liquid is changed into a vapor by removing heat from the air which is then discharged into the passenger compartment
10	q.	Line connecting the evaporator outlet to the compressor inlet

8. Remote bulb
9. Plenum blower
10. Suction line
11. Drier
12. Receiver-drier
13. Thermostatic switch
14. Compressor
15. Air inlet valve
16. Filter
17. Evaporator

LAP ASSIGNMENT SHEET #1

AIR CONDITIONING COMPONENTS (Continued)

__20__ r. Spring-loaded valve similar to a tire valve located inside the service valve fitting and used on some control devices to hold refrigerant in the system

__23__ s. Assembly mounted on the compressor crankshaft permitting the shaft to be turned without loss of refrigerant or oil

__18__ t. Fittings located on the service valves and on some control devices to connect manifold gauge set charging hoses to air-conditioning system

__26__ u. Outside air sensing switch used to control compressor clutch operation and prevent compressor operation at low temperatures when air conditioning is not required

__24__ v. Component of a refrigeration system in which refrigerant vapor is changed to a liquid by the removal of heat

__22__ w. Hose that connects the compressor outlet to the condenser inlet

__19__ x. Back pressure regulated device that prevents evaporator core freeze-up

__21__ y. Motor-driven fan used to force air through the evaporator and to circulate the cooled air through the passenger compartment of the automobile

__25__ z. Coupling device used to turn the compressor on and off electrically

18. Service port
19. Suction throttling valve (STV, POA, and EPA valves)
20. Schrader valve
21. Blower fan
22. Discharge line
23. Compressor shaft seal
24. Condenser
25. Magnetic clutch
26. Ambient compressor switch

2. Stop. Have your instructor evaluate your Assignment Sheet and mark the appropriate blank.

_____ Proceed to Learning Step 7.

_____ Study Section I of the Information Sheet and then continue to Learning Step 6.

SECTION D--ACCESSORIES
UNIT I--AIR CONDITIONING

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. Match terms and definitions associated with air conditioning. Write the correct numbers in the blanks. (Answers for "a" through "j" are on this page.)

9 a.	Device used to control temperature, humidity, and air movement	1. Air inlet valve
1 b.	Adjustable door in the plenum blower assembly that permits selection of outside and inside air for heating and cooling systems	2. Charge
8 c.	Temperature of air surrounding an air-conditioned unit, such as a vehicle or building	3. Back seating
6 d.	Outside air sensing switch used to control compressor clutch operation and prevent compressor operation at low temperatures when air conditioning is not required	4. Boiling point
3 e.	Act of turning the service valve stem all the way counterclockwise until the valve is seated	5. Can valve
10 f.	Motor-driven fan used to force air through the evaporator and to circulate the cooled air through the passenger compartment of the automobile	6. Ambient compressor switch
4 g.	Temperature at which a liquid changes to a vapor	7. Charging
5 h.	Mechanical device used to pierce, dispense, and seal small cans of refrigerant	8. Ambient air temperature
2 i.	Specific amount of refrigerant or oil by volume or weight	9. Air conditioner
7 j.	Act of placing a charge of refrigerant or oil into the air conditioning system	10. Blower fan

LAP ASSIGNMENT SHEET #2

(Answers for "k" through "v" are on this page.)

19	k.	Gas; gaseous state of refrigerant
13	l.	Gauge that will register both pressure and vacuum; used on the low side of the system
21	m.	Component of the refrigeration system that pumps refrigerant vapor and increases the pressure of the refrigerant
11	n.	Assembly mounted on the compressor crankshaft permitting the shaft to be turned without loss of refrigerant or oil
22	o.	Act of changing vapor to a liquid
14	p.	Component of a refrigeration system in which refrigerant vapor is changed to a liquid by the removal of heat
16	q.	Substance other than refrigerant and refrigeration oil in the system
18	r.	Drying agent used in refrigeration systems to remove excess moisture
20	s.	To bleed some or all of the refrigerant from a system by opening a valve or connection and permitting the refrigerant to escape slowly
17	t.	Hose that connects the compressor outlet to the condenser inlet
12	u.	That portion of the refrigeration system under high pressure, extending from the compressor outlet to the thermostatic expansion valve inlet
15	v.	Device containing desiccant placed in the liquid line to absorb moisture in the system

11. Compressor shaft seal
12. Discharge side
13. Compound gauge
14. Condenser
15. Drier
16. Contaminant
17. Discharge line
18. Desiccant
19. Vapor
20. Discharge
21. Compressor
22. Condensation

LAP ASSIGNMENT SHEET #2

(Answers for "w" through "gg" are on this page.)

24	w.	System short of refrigerant which will result in improper cooling
30	x.	To create a vacuum within a system to remove all traces of air and moisture
32	y.	Component of an air conditioning system in which refrigerant liquid is changed into a vapor by removing heat from the air which is then discharged into the passenger compartment
26	z.	Thermometer scale using 0° as the freezing point of water and 100° as the boiling point of water
33	aa.	Device used with the drier or as a separate unit to remove foreign solid material from the refrigerant
27	bb.	Condition caused by too much liquid refrigerant being metered into the evaporator
29	cc.	To remove solid particles such as metal flakes or dirt from refrigerant passages
23	dd.	Formation of a froth of the oil and refrigerant due to rapid boiling out of the refrigerant dissolved in the oil when the pressure is suddenly reduced
31	ee.	Failure of a unit to operate properly due to the formation of ice at the expansion valve orifice or on the evaporator coils or fins
25	ff.	Act of closing compressor service valves by turning them all the way clockwise
28	gg.	Pressure of the refrigerant from the discharge reed valve through lines and condenser to the expansion valve orifice

23. Foaming
24. Undercharge
25. Front seating
26. Celsius
27. Flooding
28. Head pressure
29. Flush
30. Evacuate
31. Freeze-up
32. Evaporator
33. Filter

LAP ASSIGNMENT SHEET #2

(Answers for "hh" through "tt" are on this page.)

36	hh.	Mechanical device used to evacuate the refrigeration system to rid it of excess moisture and air
44	ii.	Less than atmospheric pressure; expressed in inches of mercury
45	jj.	Device located on the discharge side of the compressor to allow the technician to check high side pressure and perform other necessary operations
38	kk.	Low side pressure higher than normal due to a malfunction of the system
39	ll.	To isolate or seal off with a nonconductor
42	mm.	Any device used to detect leaks in an air-conditioning system
35	nn.	Line connecting the drier outlet with the expansion valve inlet
43	oo.	High side pressure lower than normal due to a malfunction of the system
46	pp.	Device located on the suction side of the compressor to allow the technician to check low side pressure or perform other necessary service operations
37	qq.	Pressure lower than normal in the suction side of the system due to a malfunction of the unit
34	rr.	Coupling device used to turn the compressor on and off electrically
41	ss.	Indication of too much refrigerant or refrigeration oil in the system
40	tt.	Force per unit of area; pressure of refrigerant is measured in pounds per square inch (psi) or kilopascals (kPa)

34. Magnetic clutch
35. Liquid line
36. Vacuum pump
37. Low suction pressure
38. High suction pressure
39. Insulate
40. Pressure
41. Overcharge
42. Leak detector
43. Low head pressure
44. Vacuum
45. High side service valve
46. Low side service valve

LAP ASSIGNMENT SHEET #2

(Answers for "uu" through "ddd" are on this page.)

__49__ uu. Difference in pressure between any two points that may be caused by a restriction or friction

__52__ vv. To remove moisture and air from a system or a component by flushing with a dry gas refrigerant

__56__ ww. Air that is forced through the condenser coils by the movement of the vehicle or action of the fan

__50__ xx. Combination container for the storage of liquid refrigerant and desiccant

__53__ yy. Positive displacement compressor with pistons that travel back and forth in a cylinder

__47__ zz. Thin leaves of steel located in the valve plate of automotive compressors to act as suction and discharge valves

__54__ aaa. Refrigerant used in automotive air conditioners

__51__ bbb. Complete circulation of refrigerant through an air-conditioning system accompanied by changes in temperature and pressure, such as changes of state from vapor to liquid to vapor

__55__ ccc. Highly refined oil free from all contaminants, such as sulfur, moisture, and tars

__48__ ddd. Sensing device connected to the expansion valve by a capillary tube to sense temperature and transmit pressure to the expansion valve for its proper operation

47. Reed valves
48. Remote bulb
49. Pressure drop
50. Receiver-drier
51. Refrigeration cycle
52. Purge
53. Reciprocating compressor
54. Refrigerant-12 (R-12)
55. Refrigeration oil
56. Ram air

(Answers for "eee" through "mmm" are on this page.)

__61__ eee. Spring-loaded valve similar to a tire valve located inside the service valve fitting and used on some control devices to hold refrigerant in the system

__64__ fff. Housing on the fire wall inside the engine compartment containing air ducts, air valves, and blower

__60__ ggg. Fitting located on the service valves and on some control devices to connect manifold gauge set charging hoses to air-conditioning system

__57__ hhh. Condition caused by poor air circulation or a thermostat out of adjustment causing the air conditioning unit to run for very short periods

__58__ iii. Line connecting the evaporator outlet to the compressor inlet

__62__ jjj. That portion of the refrigeration system under low pressure extending from the expansion valve outlet to the compressor inlet

__63__ kkk. Back pressure regulated device that prevents evaporator core freeze-up

__65__ lll. Compressor inlet pressure which reflects the pressure of the system on the low side

__59__ mmm. Temperature-sensitive switch used to control the compressor clutch and cycle the compressor as a means of temperature control in an air-conditioning system

57. Short cycling
58. Suction line
59. Thermostatic switch
60. Service port
61. Schrader valve
62. Suction side
63. Suction throttling valve (STV, POA, and EPA valves)
64. Plenum blower assembly
65. Suction pressure

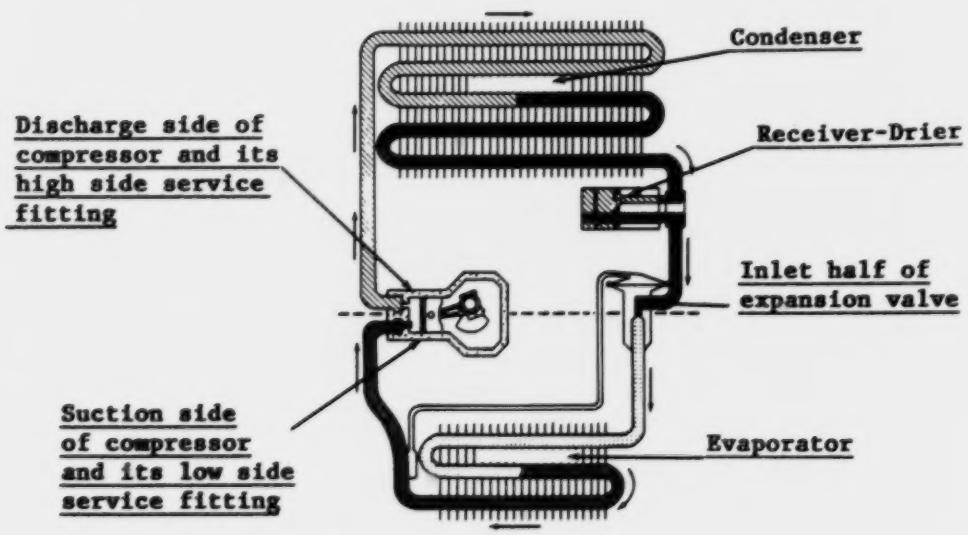
2. Stop. Have your instructor evaluate your Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.

SECTION D--ACCESSORIES
UNIT I--AIR CONDITIONING

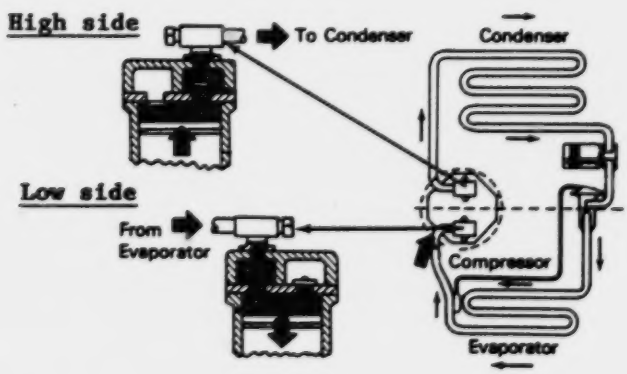
LAP ASSIGNMENT SHEET #3

NAME _____ SCORE _____

1. Label the components of the refrigeration system illustrated below. Write the correct names in the blanks.


Condenser
Receiver-Drier
Discharge side of compressor and its high side service fitting
Inlet half of expansion valve
Suction side of compressor and its low side service fitting
Evaporator

2. Label the high and low sides of the compressor illustrated below. Write the correct names in the blanks.



Which side of the compressor is the discharge side? High side

LAP ASSIGNMENT SHEET #3

3. State the safety rule that pertains to each of the following items.

a. Fumes-- Do not inhale fumes from burned fluorcarbon gases

b. Temperature of refrigerant can-- Do not warm a refrigerant can over 125° F (51° C)

c. Handling a refrigerant container-- Do not abuse a refrigerant container

d. Refrigerant container and high side pressure-- Do not allow high side pressure to enter refrigerant container

e. Eye protection-- Wear safety glasses and a full face shield or sealed goggles while working on an air conditioning system

f. Torch-- Do not apply torch to a pressurized system

g. Pressure hoses, gauges, and connections-- Inspect all pressure hoses, gauges and connections before using

h. Gas-filled area-- Ventilate a gas-filled area before working there

i. Liquid refrigerant and a compressor--Do not pump liquid refrigerant into a compressor

4. State the function of a receiver-drier.

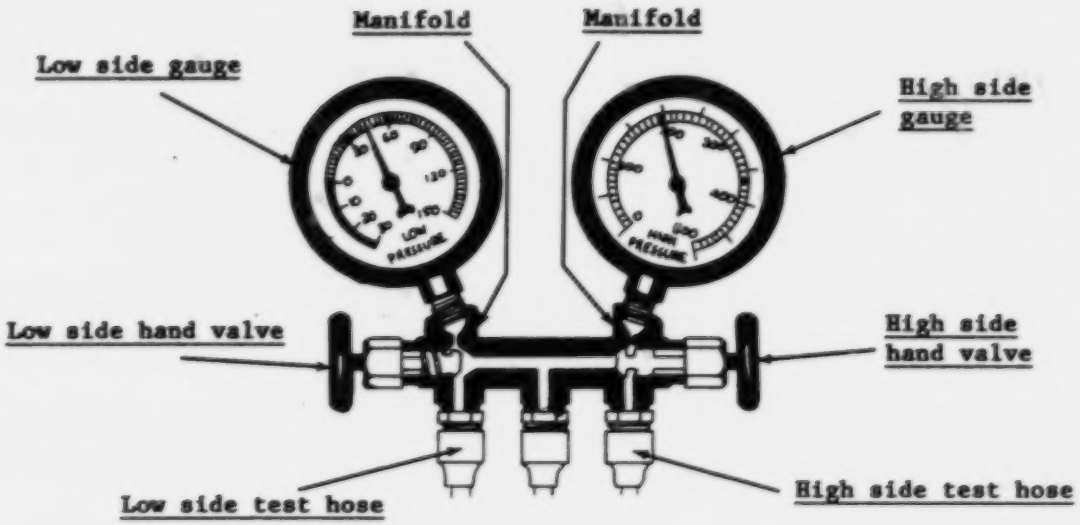
To provide storage of liquid refrigerant and to absorb moisture

LAP ASSIGNMENT SHEET #3

5. Label the back seat, midposition, and front seat of the service valves illustrated below.

a. Back seat b. Midposition c. Front seat

6. Label the components of the manifold gauge illustrated below. Write the correct names in the blanks.



7. Stop. Have your instructor evaluate your Assignment Sheet and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

II _____ III _____ IV _____ V _____ VI _____ VII _____

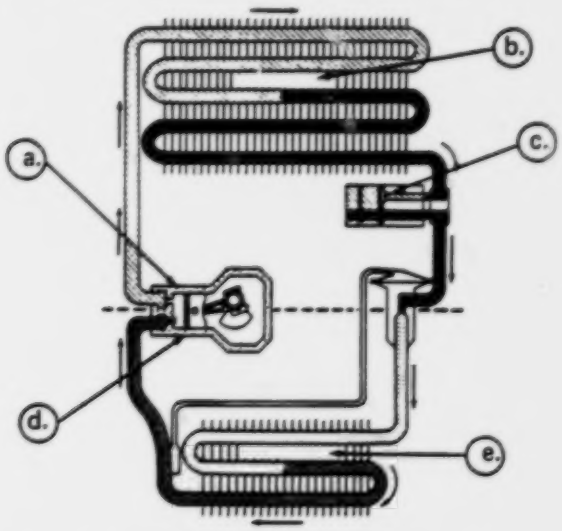
If none of the above Sections are checked, proceed to Learning Step 10. Otherwise, continue to Learning Step 9.

SECTION D--ACCESSORIES
UNIT I--AIR CONDITIONING

LAP ASSIGNMENT SHEET #4

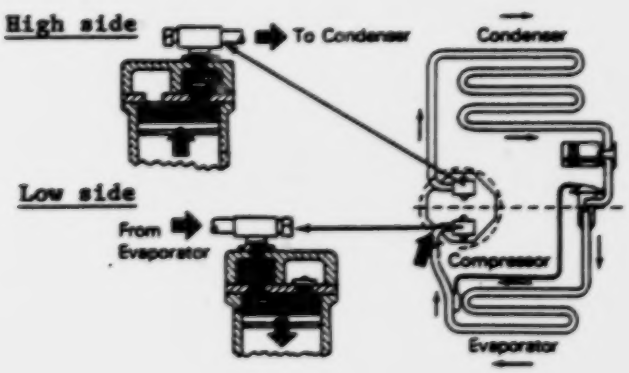
NAME _____ SCORE _____

1. Identify the components of the refrigeration system illustrated below. Write the correct names of the components in the blanks.



a. Discharge side of the compressor
b. Condenser
c. Receiver
d. Suction side of the compressor
e. Evaporator

2. Label the high and low sides of the compressor illustrated below. Write the correct names in the blanks.



LAP ASSIGNMENT SHEET #4

3. List safety rules for automotive air conditioning.

a. Do not inhale fumes from burned fluorocarbon gases

b. Do not warm a refrigerant can over 125° F (51° C)

c. Do not abuse a refrigerant container

d. Do not allow high side pressure to enter refrigerant container

e. Wear safety glasses and a full face shield or sealed goggles while working on an air-conditioning system

f. Do not apply torch to a pressurized system

g. Inspect all pressure hoses, gauges, and connections before using

h. Ventilate a gas-filled area before working there

i. Do not pump liquid refrigerant into a compressor

4. Fill in the blanks to complete the following statement concerning the function of a receiver-drier (dehydrator).

To provide storage of liquid refrigerant and to absorb moisture in the system.

LAP ASSIGNMENT SHEET #4

5. Label the back seat, midposition, and front seat of the service valves illustrated below. Write the correct name of each in the blanks below, and then describe the function of each.

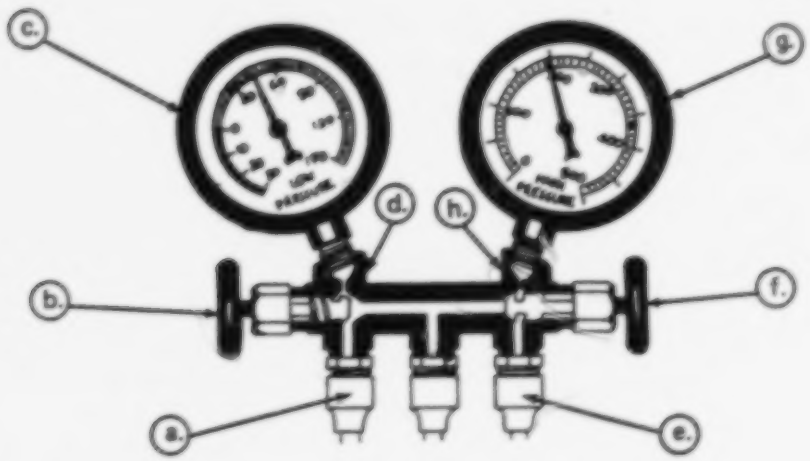
a. Front seat -- The shut-off position to isolate compressor from the system

b. Midposition -- Test position to connect service gauge port into system so that gauge readings may be taken while system is operating

c. Back seat -- The normal operating position to seal off service gauge port

LAP ASSIGNMENT SHEET #4

6. Identify the components of the manifold gauge set illustrated below. Write the correct names in the blanks.



a. Low side test hose

b. Low side hand valve

c. Low side gauge

d. Manifold

e. High side test hose

f. High side hand valve

g. High side gauge

h. Manifold

7. Stop. Have your instructor evaluate your Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 10. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 10.

State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for AUTO MECHANICS II

LAP NO. _____ CODE: _____

MAJOR INSTRUCTIONAL AREA SECTION D--ACCESSORIES

INSTRUCTIONAL UNIT UNIT II--HEATERS

LEARNING ACTIVITY PACKET NO. 21

PREREQUISITE LAP(S) None

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Heaters." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.

INTRODUCTION: The course of study in this LAP will help the student become able to identify the components of the heater and to pressure test and back flush the heater core, change the flow control valve, and test the blower motor.

TASKS INCLUDED IN THIS LAP:

1. Pressure test a heater.
2. Back flush a heater core.
3. Remove and replace a water control valve.
4. Test a blower motor for current draw.

SECTION D--ACCESSORIES
UNIT II--HEATERS

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____ 1.	Read	Unit and Specific Objectives, page AM II-87-D.
_____ 2.	Complete	Heaters Pretest, LAP page 9.
_____ 3.	Study	The sections of the Information Sheet, pages AM II-91-D and 92-D, indicated by your instructor on your pretest.
_____ 4.	Refer	To Step 6 of your pretest. If additional study is indicated for any of the Information Sheet, Sections I through V, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.
_____ 5.	Do	LAP Assignment Sheet #1, LAP page 13.
_____ 6.	Do	LAP Assignment Sheet #2, LAP page 17.
_____ 7.	Check	The following tasks that you think you can perform without supervision.

Student Check		Instructor Initials/Date: Skilled	Moderately Skilled
_____a.	Pressure test a heater (12)	_____	_____
_____b.	Back flush a heater core (18)	_____	_____

LEARNING STEPS

Student Check		Instructor Initials/Date Skilled	Moderately Skilled
_____c.	Remove and replace a water control valve (24)	_____	_____
_____d.	Test a blower motor for current draw (30)	_____	_____

_____ 8. Discuss — Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 33. Otherwise, continue to Learning Step 9.

_____ 9. Refer — To Learning Step 7a. If this task has been initialed by your instructor, proceed to Learning Step 15. Otherwise, continue to Learning Step 10.

_____10. Study — Job Sheet #1--Pressure Test a Heater, page AM II-97-D.

_____11. Watch — Slide/tape presentation, "Pressure Test a Heater" (D-II-1).

_____12. Do — Job Sheet #1--Pressure Test a Heater.

_____13. Stop. — Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, proceed to Learning Step 15. Otherwise, repeat Learning Steps 10 through 12 and then continue to Learning Step 14.

LEARNING STEPS

_____14.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, continue to Learning Step 15. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 15.
_____15.	Refer	To Learning Step 7b. If this task has been initialed by your instructor, proceed to Learning Step 21. Otherwise, continue to Learning Step 16.
_____16.	Study	Job Sheet #2--Back Flush a Heater Core, page AM II-99-D.
_____17.	Watch	Slide/tape presentation, "Back Flush a Heater Core" (D-II-2).
_____18.	Do	Job Sheet #2--Back Flush a Heater Core.
_____19.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, proceed to Learning Step 21. Otherwise, repeat Learning Steps 16 through 18 and then continue to Learning Step 20.
_____20.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, continue to Learning Step 21. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 21.
_____21.	Refer	To Learning Step 7c. If this task has been initialed by your instructor, proceed to Learning Step 27. Otherwise, continue to Learning Step 22.

LEARNING STEPS

_____22.	Study	Job Sheet #3--Remove and Replace a Water Control Valve, page AM II-101-D.
_____23.	Watch	Slide/tape presentation, "Remove and Replace a Water Control Valve" (D-II-3).
_____24.	Do	Job Sheet #3--Remove and Replace a Water Control Valve.
_____25.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, proceed to Learning Step 27. Otherwise, repeat Learning Steps 22 through 24 and then continue to Learning Step 26.
_____26.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, continue to Learning Step 27. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 27.
_____27.	Refer	To Learning Step 7d. If this task has been initialed by your instructor, proceed to Learning Step 33. Otherwise, continue to Learning Step 28.
_____28.	Study	Job Sheet #4--Test a Blower Motor for Current Draw, page AM II-103-D.
_____29.	Watch	Slide/tape presentation, "Test a Blower Motor for Current Draw" (D-II-4).
_____30.	Do	Job Sheet #4--Test a Blower Motor for Current Draw.

LEARNING STEPS

_____31.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, proceed to Learning Step 33. Otherwise, repeat Learning Steps 28 through 30 and then continue to Learning Step 32.
_____32.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, continue to Learning Step 32. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 32.
_____33.	Review	Information Sheet (page AM II-91-D) and LAP Assignment Sheets.
_____34.	Take	Heaters Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

SECTION D--ACCESSORIES
UNIT II--HEATERS

PRETEST

NAME _____ SCORE _____

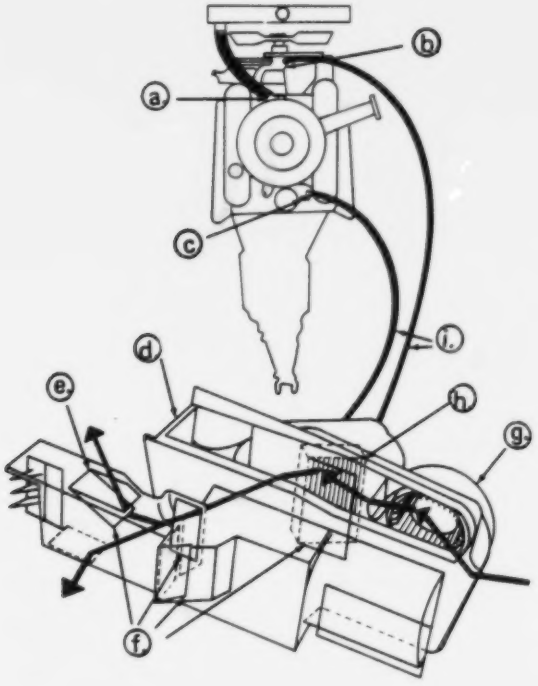
DIRECTIONS: This pretest is to determine how much you already know about heaters. Your performance on this pretest will not be used to determine your grade in the course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing may prevent you from receiving needed instruction.

1. Match terms and definitions associated with heaters. Write the correct numbers in the blanks.

4	a. Radiator type device used in the heater to pass hot water through to heat the air flowing through the heater	1. Heater plenum
2	b. Vacuum or manually operated valve which controls coolant flow in the heater core	2. Water control valve
1	c. Housing for the heater core, fan, and passageways for delivering air through the system	3. Control system
3	d. Group of doors and deflectors operated by a vacuum system or manual linkage to control air flow in the heater-defroster system	4. Heater core
5	e. Segment of the heater that deflects air to the windshield for thawing ice or vapors	5. Defroster
6	f. Motor-driven fan used to move air through the heater-defroster	6. Blower
7	g. Device that maintains engine coolant temperature to a specified range, thereby providing the heater with hot coolant	7. Thermostsat (engine)

2. Identify components of the heating system illustrated below. Write the correct letters in the blanks.

__i__ Heater hoses	__g__ Blower
__a__ Thermostat (engine)	__c__ Water control valve
__h__ Heater core	__b__ Water pump (engine)
__e__ Defroster	__f__ Control system
__d__ Heater plenum	



3. State reasons for using coolant instead of water throughout the year.

a. **Eliminates corrosion**

b. **Reduces possibility of air conditioning system freezing the heater core**

c. **Extends life of cooling system components**

d. **Allows system to operate at higher temperatures without boiling**

4. List three methods of controlling heater temperature.

   a. Control flow of coolant in heater core

   b. Control air flow through the heater core

   c. Mix outside air (cold air) with heated air

5. Arrange in order the processes of heater operation. Write a "1" before the first process, a "2" before the second, and so on.

   3 Air around the core is moved across the core and into the passenger compartment by the blower through the heater plenum

   1 Hot coolant is forced through the heater core by the water pump

   4 Air may be drawn in from outside or recirculated in the passenger compartment

   2 Heat from the coolant is conducted through the thin core metal and into the surrounding air

6. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

   Refer to Information Sheet, Section(s)

   I _____ II _____ III _____ IV _____ V _____

   If none of the above sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 3.

SECTION D--ACCESSORIES
UNIT II--HEATERS

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Match terms and definitions associated with heaters. Select a term from the list below and write it in the blank before its definition.

Defroster	Water control valve
Heater core	Thermostat (engine)
Blower	Control system
Heater plenum	

a. Blower --Motor-driven fan used to move air through the heater-defroster

b. Heater core --Radiator type device used in the heater to pass hot water through to heat the air flowing through the heater

c. Defroster --Segment of the heater that deflects air to the windshield for thawing ice or vapors

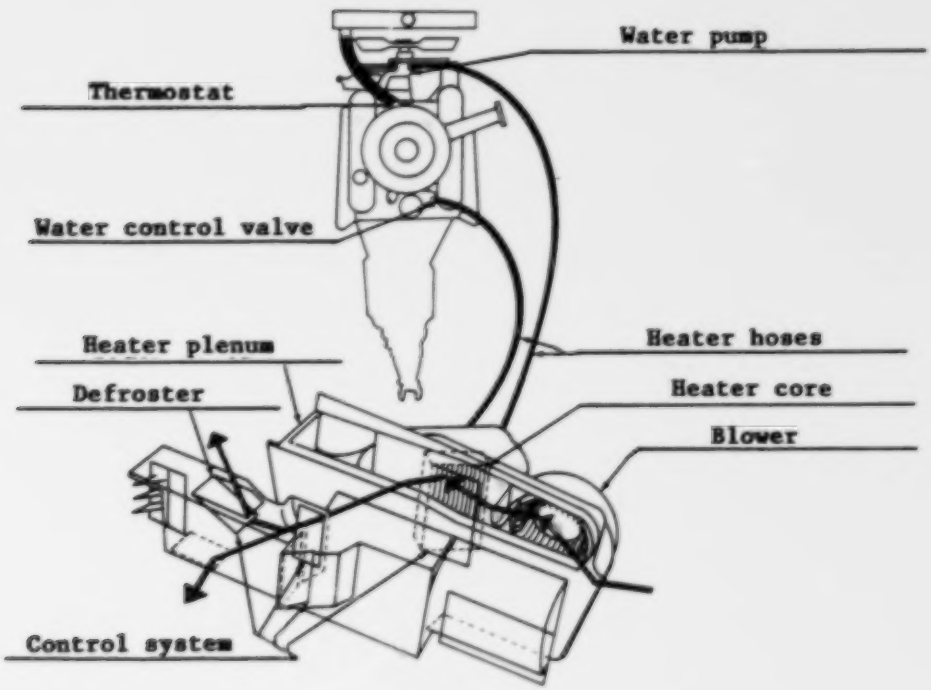
d. Heater plenum --Housing for the heater core, fan, and passageways for delivering air through the system

e. Thermostat (engine) --Device that maintains engine coolant temperature to a specific range, thereby providing the heater with hot coolant

f. Water control valve --Vacuum or manually operated valve which controls coolant flow in the heater core

g. Control system --Group of doors and deflectors operated by a vacuum system or manual linkage to control air flow in the heater-defroster system

2. Label components of the heater in the illustration below. Write the correct names in the blanks.



3. State the reasons for using coolant instead of water throughout the year. The following "hints" will help you.

Corrosion Boiling Freezing Components

a. Eliminates corrosion

b. Reduces possibility of air conditioning system freezing the heater core

c. Extends life of cooling system components

d. Allows system to operate at higher temperatures without boiling

4. Fill in the missing words to complete the following methods of controlling heater temperature.

a. Control flow of coolant in heater core.

b. Control air flow in heater core.

c. Mix outside air (cold air) with heated air.

5. Fill in the missing words to complete the processes of heater operation.

   a. Hot coolant is forced through the heater core by the water pump.

   b. Heat from the coolant is conducted through the thin core metal and into the surrounding air.

   c. Air around the core is moved across the core and into the passenger compartment by the blower through the heater plenum.

   d. Air may be drawn in from outside or recirculated in the passenger compartment.

6. Stop. Have your instructor evaluate your Assignment Sheet and mark the area(s) below requiring additional study.

   Refer to Information Sheet, Section(s):

   I _____ II _____ III _____ IV _____ V _____

   If none of the above sections are checked, proceed to Learning Step 7. Otherwise, continue to Learning Step 6.

SECTION D--ACCESSORIES
UNIT II--HEATERS

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. Fill in the missing words to complete the following definitions of terms associated with heaters.

   a. Defroster--Segment of the heater that **deflects** air to the **windshield** for thawing ice or vapors

   b. Heater core--Radiator type device used in the heater to pass **hot** **water** through to heat the air flowing through the heater

   c. Blower--Motor-driven **fan** used to move air through the **heater** - **defroster**

   d. Thermostat (engine)--Device that maintains engine **coolant** **temperature** to a specified range, thereby providing the heater with hot coolant

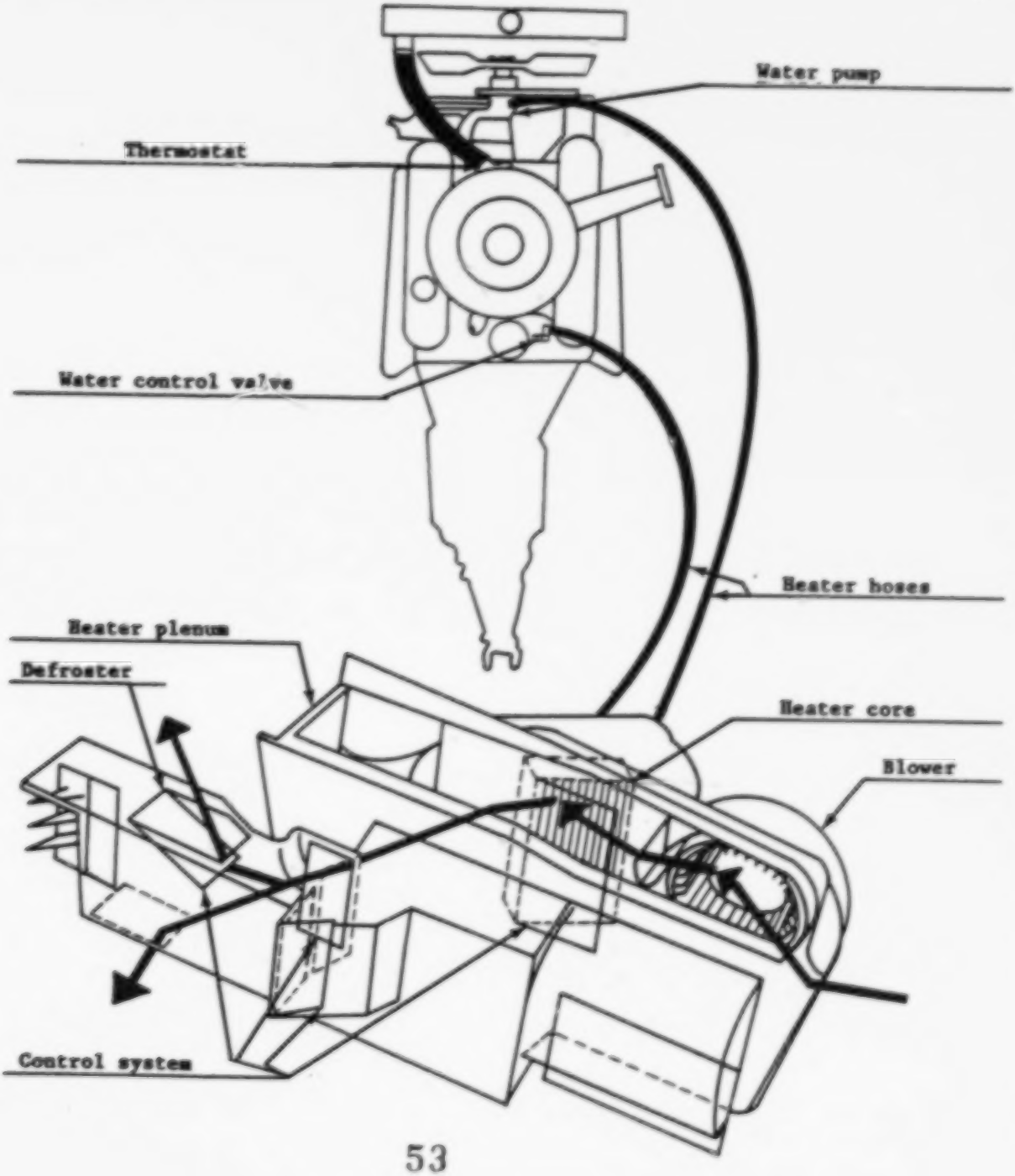
   e. Heater plenum--**housing** for the heater core, fan, and passageways for delivering air through the system

   f. Water control valve--**vacuum** or manually operated valve which controls coolant **flow** in the heater core

   g. Control system--Group of **doors** and **deflectors** operated by a vacuum system or **manual** **linkage** to control air flow in the heater-defroster system

LAP ASSIGNMENT SHEET #2

2. Label components of the heater illustrated below. Write the correct names in the blanks.



53

LAP ASSIGNMENT SHEET #2

3. Fill in the blanks to complete reasons for using coolant instead of water throughout the year.

   a. Eliminates corrosion.

   b. Reduces possibility of air conditioning system freezing the heater core.

   c. Extends life of cooling system components.

   d. Allows system to operate at higher temperatures without boiling.

4. List the methods of controlling heater temperature.

   a. Control flow of coolant in heater core

   b. Control air flow through the heater core

   c. Mix outside air (cold air) with heated air

5. List in order the processes of heater operation.

   a. Hot coolant is forced through the heater core by the water pump

   b. Heat from the coolant is conducted through the thin core metal and into the surrounding air

   c. Air around the core is moved across the core and into the passenger compartment by the blower through the heater plenum

   d. Air may be drawn in from outside or recirculated in the passenger compartment

6. Stop. Have your instructor evaluate your Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.